

REMARKS

The Examiner is thanked for the careful review of the application as set forth in the outstanding office action. Reconsideration of the application in view of the foregoing amendments and the following discussion is respectfully requested.

Claims Rejections - 35 USC 102

Claims 1-5, 10-11, 13-15, 25-28 and 31 stand rejected as being anticipated by Haselby et al. ("Haselby"), US 4,916,638. This rejection is respectfully traversed on the grounds that a prima facie case of anticipation has not been established, and the reference does not describe each claim element.

Claim 1 has been cancelled without prejudice. Claim 2 has been amended for the sole purpose of placing the claim in independent form.

Applicant does not agree with the Examiner's recitation of alleged teachings of Haselby. For example, the Examiner asserts that Haselby describes "said step of providing relative motion is carried out on the fly (col. 4, lines 1-48) as the portion of the image is being printed and the print element is moving in the scan axis." Applicant denies that Haselby describes "providing relative motion between the print medium and the printing element to accurately position the printing element in dependence on the sensed position of the edge of the just printed portion of the image to align the top edge of the next swath to be printed in relation to the bottom edge of the previously printed swath, wherein said step of providing relative motion is carried out on the fly as the portion of the image is being printed and the print element is moving in the scan axis." See, Haselby, at 5:1-13.

Similar considerations apply to Claim 31.

Claims 4-5 as amended depend from Claim 2, and are also not anticipated by Haselby.

Claim 13:

Claim 13 is drawn to a swath printer, comprising:

[A] a computer-controlled printing structure;

[B] a carriage for holding the printing structure, said carriage mounted for movement along a swath axis at a print area for swath printing of an image on a print medium;

[C] a carriage drive system for driving the carriage along the swath axis;

[D] an optical sensor system mounted to the carriage for sensing the position of a bottom edge of a just printed portion of said image which is nominally aligned with the scan axis;

[E] a media advance system for moving the print media along a media path and past the print area;

[F] a fine positioning system for providing incremental relative motion between the print medium and the printing element to accurately position the printing element to align the top edge of a to-be-printed image portion in relation to the bottom edge of the just printed portion in dependence on the sensed position of the bottom edge of the just printed portion of the image.

The reference characters have been added for ease of reference.

Haselby does not describe at least element F. The Examiner has not addressed this claim element in the outstanding office action. For that reason alone, a prima facie case of anticipation of Claim 13 has not been established.

Claims 14 and 15 depend from Claim 13, and are also not anticipated by Haselby. Claim 15 further recites that the fine positioning system is actuated to provide relative motion to accurately position the printing element in relation to the print medium simultaneously as the printing structure is moved along the swath axis. The limitations of Claim 15 are also not described by Haselby.

Claim 25:

Claim 25 is drawn to a method for swath printing, comprising:

[A] printing a first swath of an image on a print medium with an ink-jet printing structure;

[B] advancing the print medium to position the medium for printing a second swath;

[C] determining zones of the second swath which need high accuracy swath alignment;

[D] begin printing the second swath;

[E] during said printing of the second swath, for those zones which need high accuracy swath alignment, determine the alignment errors and store in memory appropriate error compensation values;

[F] after completing the printing of said second swath, calculate the next media advance distance based on the stored compensation values; and

[G] advancing the media for the next swath to be completed by a distance dependent on said next media advance distance.

The reference characters have been added for ease of reference.

Haselby does not describe at least elements C, E, F and G of Claim 25. Applicant thus respectfully disagrees with the Examiner's allegations of the teachings of Haselby, including the allegations at subparagraphs (3), (5) and (7) at pages 4-5 of the office action. The citations to particular column and line numbers of Haselby do not support the allegations, and applicant does not understand how these passages relate to the claim limitations. For these reasons, a prima facie case of anticipation of Claim 25 has not been established.

Claim 27:

This claim has been rewritten in independent form, and recites that said step of sensing the position of the trailing edge and said step of providing relative motion between the print medium and the printing element is performed simultaneously with the step of moving the printing element along the swath axis

to print at least a portion of the fresh swath. Haselby does not disclose this limitation, as described above regarding Claim 2.

Claim 31: Haselby does not describe each element of Claim 31, including for example "providing relative motion between the print medium and the printing element on the fly as the portion of the image is being printed and the print element is moving in the scan axis to accurately position the printing element in dependence on the sensed position of the edge of the just printed portion of the image," as described above regarding Claim 2.

For these reasons, a prima facie case of anticipation has not been established, and Haselby does not describe each element of Claims 1-5, 10-11, 13-15, 25-28 and 31. The rejection under Section 102 should be withdrawn.

Claims Rejections - 35 USC 103

Claims 6-9 and 12 stand rejected as being unpatentable over Haselby in view of Nguyen et al. ("Nguyen"), US 5,297,017. This rejection is respectfully traversed on the grounds that a prima facie case of obviousness has not been established.

Claim 6 is drawn to a method for high accuracy media positioning in a swath printer, comprising:

- mounting a computer-controlled printing element for movement along a swath axis for swath printing of an image on a print medium;

- moving the printing element along the swath axis and printing at least a portion of a swath of the image on the print medium;

- sensing the position of an edge of the just printed portion of said image which is nominally aligned with the scan axis;

- providing relative motion between the print medium and the printing element to accurately position the printing element in dependence on the sensed position of the edge of the just printed portion of the image,

said providing relative motion comprising moving the printing element in a direction transverse to the swath axis.

The Examiner's allegations regarding Haselby have been addressed above regarding the rejection under Section 102.

The Examiner cites Nguyen as allegedly in the same field of endeavor for swath printers, and alleges that the reference "teaches a method for moving the printing element in a direction transverse to the swath axis (moving ink jet nozzles perpendicular to the swath axis (vertical alignment of ink jet nozzles of the printhead), fig. 3, abstract, col. 1, lines 60-67 to col. 2, lines 1-6 and col. 21, lines 40-50). The Examiner further alleges that it would have been obvious to modify Haselby "as per teachings of Nguyen because of a following reason (1) to provide a better and an accurate position of the printhead for printing the next swath by moving the printing element transverse to the swath axis, (2) to avoid banding of the resulting or printed product (Haselby, col. 8, lines 10-30). Applicant respectfully disagrees with the allegations of the teachings of Nguyen, and asserts that there is no motivation to combine the references in the manner suggested by the Examiner.

Nguyen describes a "print cartridge alignment in paper axis" apparatus and technique. The abstract states:

"... Alignment of the operation of the printheads along the media scan axis is performed by determining with the optical sensor the relative positions of horizontal test line segments printed by selected nozzles of the printhead cartridges. The relative position information is utilized to calculate a vertical alignment correction which is implemented by enabling selected ink jet nozzles of the printheads and adjusting the position of one printhead cartridge relative to the other such that the nozzles of the ink jet printheads are properly spaced along the media scan axis."

The alignment of the printheads is achieved during a calibration mode by printing test lines, as described at 14: 59 to 19:68. There is no teaching or suggestion that the printheads be moved in a direction transverse to the scan axis during normal printing operations. Moreover, the allegation that it would have

been obvious to modify Haselby "as per the teachings of Nguyen" is the product of hindsight reconstruction.

Similar considerations apply to dependent Claims 7-9. Moreover, Nguyen does not disclose the additional limitations, e.g. of Claim 8 (positioning an actuating element between the slider rod and the carriage; and driving the actuating element to move the carriage and the printing element to obtain the accurate positioning) and Claim 9 (positioning an actuating element between the slider rod and a corresponding slider supporting structure; and driving the actuating element to move the slider rod and with it the carriage and the printing element to obtain the accurate positioning). Applicant respectfully disagrees with the Examiner's contentions as to the teachings of Nguyen regarding these claims.

Claim 12 is drawn to a method for high accuracy media positioning in a swath printer, comprising:

- mounting a computer-controlled printing element for movement along a swath axis for swath printing of an image on a print medium;

- moving the printing element along the swath axis and printing at least a portion of a swath of the image on the print medium;

- sensing the position of an edge of the just printed portion of said image which is nominally aligned with the scan axis;

- providing relative motion between the print medium and the printing element to accurately position the printing element in dependence on the sensed position of the edge of the just printed portion of the image, said providing relative motion between the print medium and the printing element including

- mounting an actuating element between each said printing element and said carriage; and

- actuating each of said actuating elements to move the respective printing elements in a direction transverse to the swath axis.

Neither reference, alone or in combination, teaches or suggests the method of Claim 12, for reasons similar to those discussed above regarding Claim 6. Moreover, neither reference teaches or suggests "mounting an actuating element between each said printing element and said carriage; and actuating each of said actuating elements to move the respective printing elements in a direction transverse to the swath axis" as recited in Claim 12.

Claims 16-22, 24 and 29 stand rejected as being unpatentable over Haselby in view of Nguyen.

Claim 16 depends from Claim 13, and further recites that "said fine positioning system provides relative motion between the print medium and the printing element by moving the printing element in a direction transverse to the swath axis." Haselby does not teach or suggest moving the printing element in a direction transverse to the swath axis. Nguyen teaches an alignment technique used to print and sense test lines, but does not teach or suggest using moving the printing element in a direction transverse to the swath axis to provide "incremental relative motion between the print medium and the printing element to accurately position the printing element to align the top edge of a to-be-printed image portion in relation to the just printed portion in dependence on the sensed position of the bottom edge of the just printed portion of the image" as in Claim 13.

Claims 17-20 depend from Claim 16, and are allowable over the cited references for the reasons described above regarding Claim 16, and because these dependent claims add further distinguishing features not described by either applied reference.

Claims 21-22 are also not taught or suggested by the applied references, for reasons as given above regarding Claim 13 and Claim 12.

Claim 24 depends from Claim 13, and further recites that "the sensor system includes a first sensor mounted on a first side of the carriage and a second sensor mounted on a side of the carriage opposite the first side along the swath axis, the sensor system adapted for bidirectional sensing operation." The printer of Claim 24 is not taught or suggested by the applied references.

The Examiner alleges that Nguyen discloses a first sensor and a second sensor, and alleges that it would have been obvious to mount the first sensor on a first side and a second sensor on the second side (opposite to the first) to precisely adjust the printhead to an appropriate position for printing the next swath. Applicant respectfully disagree. Nguyen discloses optical sensor 65, not a first sensor and a second sensor as recited in Claim 24. The allegations that it would have been obvious to mount a first sensor and a second sensor is without foundation, and the product of improper hindsight reconstruction.

The rejection of Claim 29 should be withdrawn for reasons similar to those discussed above regarding Claim 16.

Claim 23 stands rejected as being unpatentable over Haselby in view of Yoshino. This rejection is respectfully traversed on the grounds that a prima facie case of obviousness has not been established, and the applied references do not teach or suggest the claimed invention.

Claim 23 depends from Claim 13, and further recites that the fine positioning system includes a piezoelectric actuator for providing the incremental relative motion. The Examiner alleges that Yoshino teaches a printer using a piezo actuator, and that it would have been obvious to modify Haselby "as per teachings of Yoshino because of a following reason: (1) to provide higher speed actuating element for printer (Yoshino, col. 1, lines 10-12)." Applicant respectfully disagrees. Yoshino describes a driving circuit which mechanically drives a pin of impact-type dot-matrix printers (1:6-8). Haselby does not describe a fine positioning system as recited in Claim 13. There is no teaching or suggestion to use a piezoelectric actuator for providing incremental relative motion as recited in Claim 23. The allegation of obviousness is the product of improper hindsight reconstruction. The rejection should be withdrawn.

Claim 30 stands rejected as being unpatentable over Haselby in view of Nguyen and Yoshino. Similar considerations apply to this rejection as just discussed regarding the rejection of Claim 23.

Applicant respectfully submits that the rejections under Section 103 should be withdrawn.

New Claim

New Claim 32 has been added which is drawn to a printing method comprising:

- receiving a print job from a print job source, said print job consisting of text or a graphic image, or both a text and a graphic image;

- mounting a computer-controlled printing element for movement along a swath axis for swath printing of the print job onto a print medium;

- moving the printing element along the swath axis and printing at least a portion of a swath of the print job on the print medium;

- activating a media advance mechanism to provide a nominal advance movement between the printing element and the print medium to position for a fresh swath;

- moving the printing element along the swath axis;

- sensing the position of an edge of a just printed portion of said print job swath which is nominally aligned with the scan axis, wherein said edge is a bottom edge of a previously printed swath in relation to a direction of print medium advance through the swath printer past the printing element;

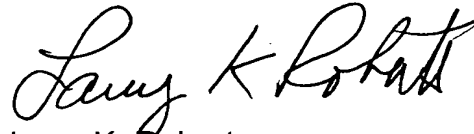
- providing relative motion between the print medium and the printing element to accurately position the printing element in dependence on the sensed position of the edge of the just printed portion of the print job to align the top edge of the next swath to be printed in relation to the bottom edge of the previously printed swath.

Haselby does not disclose "sensing the position of an edge of a just printed portion of said print job swath" where the print job consists "of text or a graphic image, or both a text and a graphic image," since Haselby senses the position of specially drawn margin lines which are not part of a print job received from a print job source. Claim 32 is in condition for allowance.

CONCLUSION

The outstanding rejections have been addressed, and the application is in condition for allowance. Such favorable reconsideration is solicited.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Larry K. Roberts".

Larry K. Roberts
Registration No. 28,464

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Law Offices of Larry K. Roberts, Inc.
P.O. Box 8569
Newport Beach, CA 92658-8569
Telephone (949) 640-6200
Facsimile (949) 640-1206